

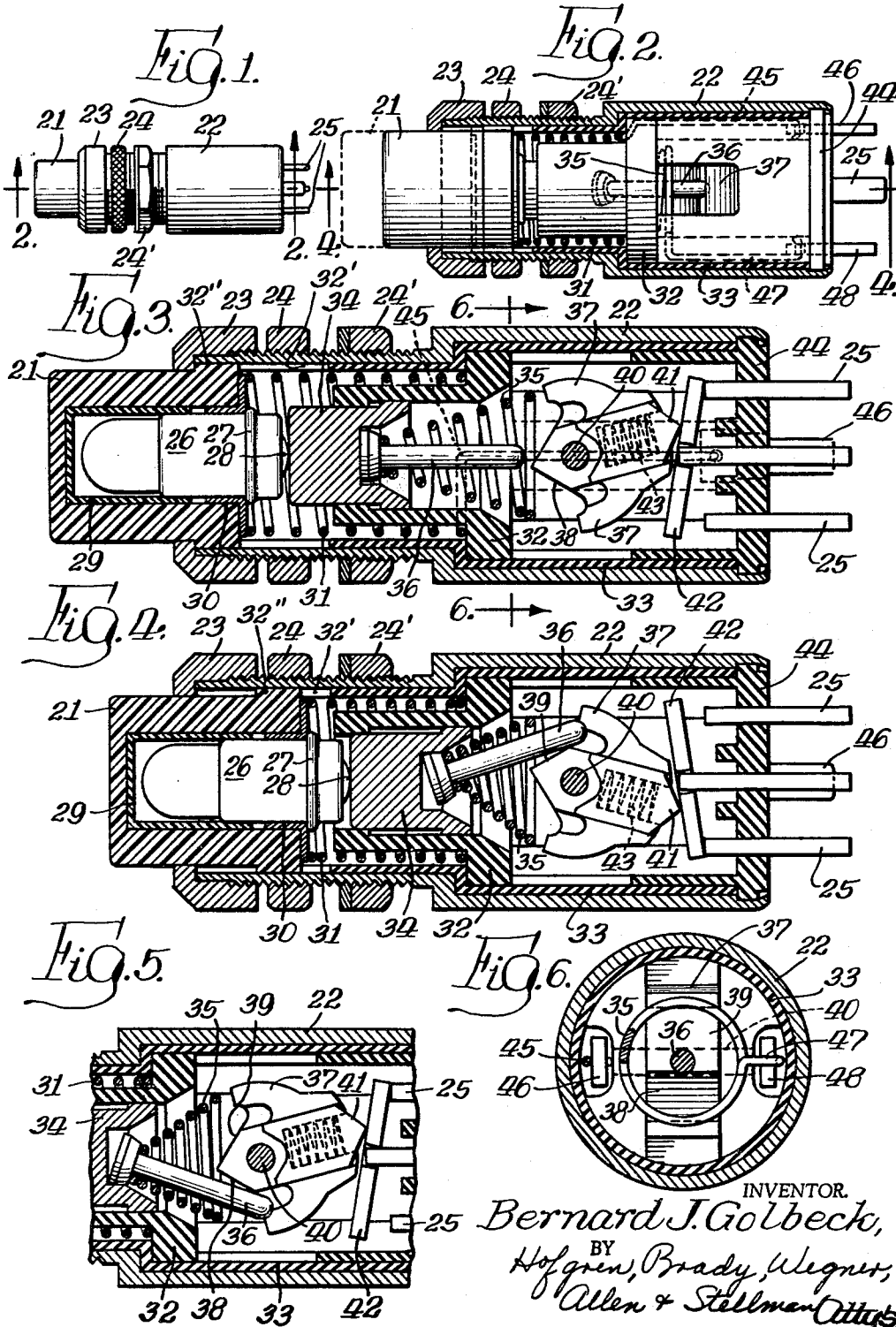
May 11, 1965

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ILLUMINATED PUSH BUTTON SWITCH USING SPRINGS
AS CONDUCTIVE ELEMENTS

3,183,333

Filed Sept. 18, 1961

3 Sheets-Sheet 1



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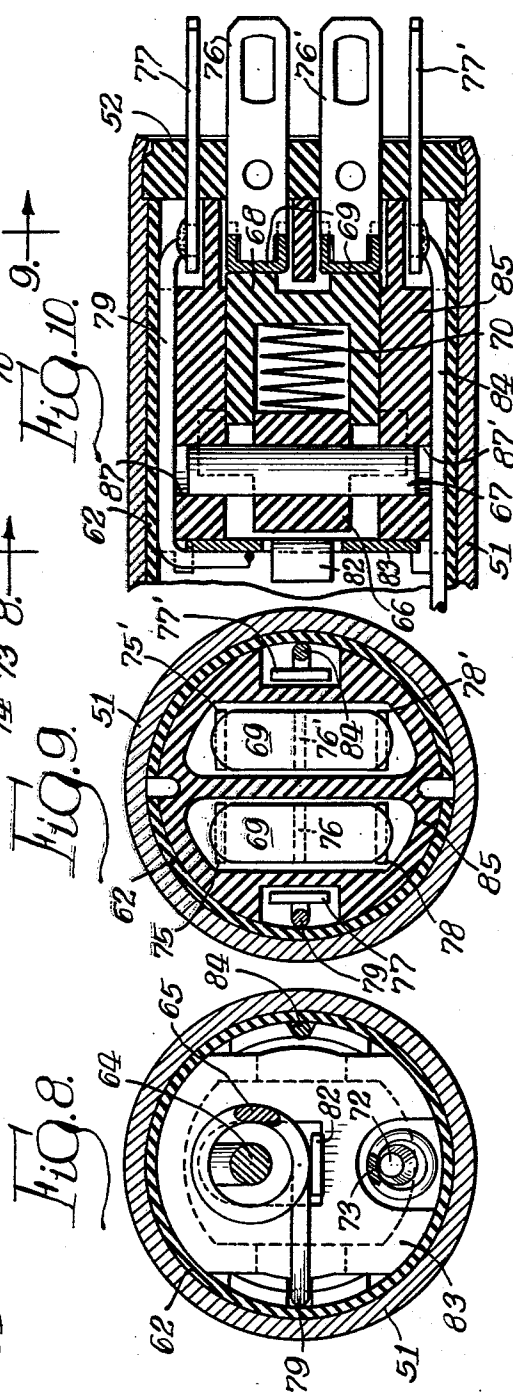
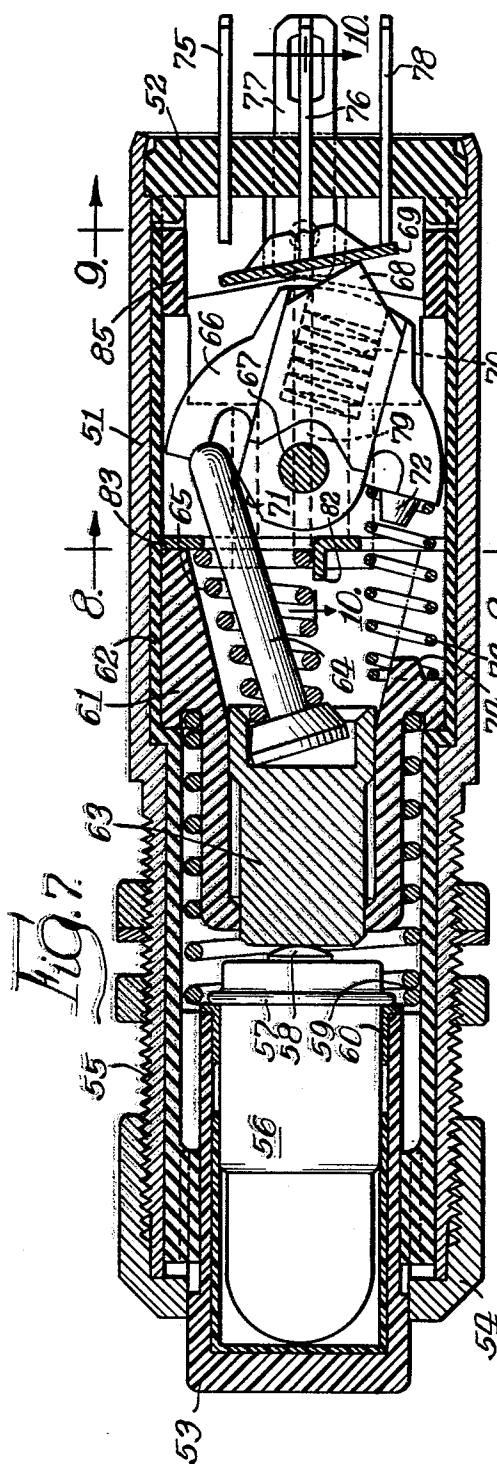
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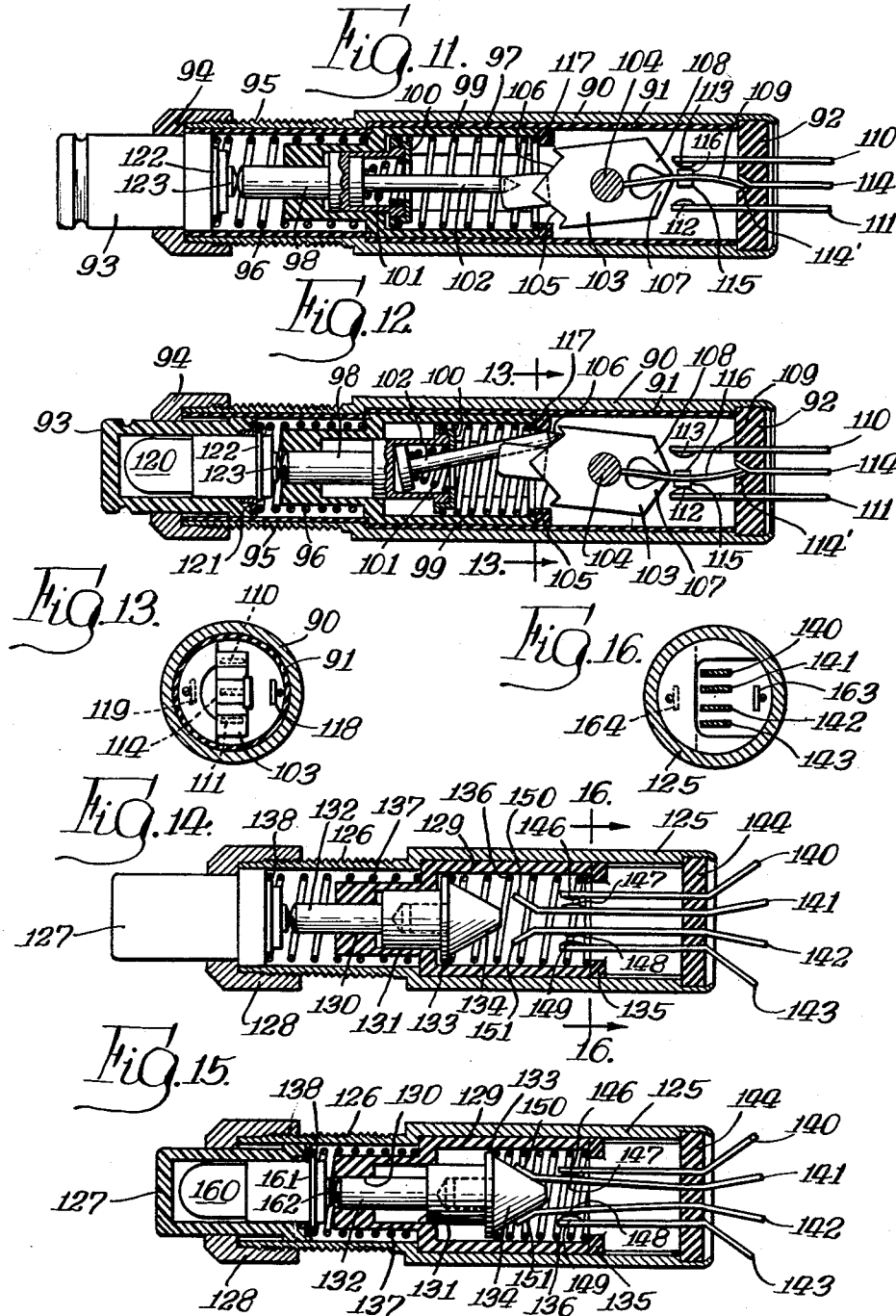
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ILLUMINATED PUSH BUTTON SWITCH USING SPRINGS AS CONDUCTIVE ELEMENTS
Bernard J. Golbeck, Crystal Lake, Ill., assignor to Oak Manufacturing Co., a corporation of Delaware
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 2 Claims. (Cl. 200—159)

This invention relates to a push button switch and more specifically to a push button switch wherein a force transmitting member is maintained in contact with the push button, movable by the push button and returnable to a rest position by the push button return member. One embodiment of the invention provides a means for lighting the push button.

In prior art devices of the push button type, considerable difficulty is encountered in providing a compact push button switch of the lighted variety. When the light source is rigidly mounted in the push button and electrically connected to terminals for energizing, considerable space is taken up in providing room for the push button to move.

Further problems are encountered in providing the electrical connection to movable light sources mounted within the push button and considerable expense is involved along with manufacturing difficulties.

It is therefore an object of this invention to provide an improved push button switch.

It is a further object of this invention to provide a push button switch of improved mechanical construction and compactness.

Still another object of this invention is to provide a lighted push button switch wherein separate electrical connections to the light source are completed through the springs which return the push button to its extended position.

Yet another object of the invention is to provide a quick and easy means for replacing the light bulb in a push button switch.

It is therefore a feature of this invention to provide a push button switch for controlling electrical circuits comprising an open end housing, and a light transparent push button slidably mounted in the open end of the housing and retained therein for limited longitudinal motion. There is further provided a light source having first and second terminals maintained in contact with the push button by a first spring in electrical contact with the first terminal. An electrically conductive plunger is slidably mounted in the housing and maintained in contact with the second terminal of the light source by a second spring. A switch having two positions and a plurality of contacts actuatable by said plunger, when switch actuating motion of the push button is transmitted to the plunger through the second terminal is provided. In addition, means including a plurality of terminal posts extending through the housing for coupling the switch contacts to the electrical circuits is provided. And means are further provided including two terminal posts extending through the housing electrically connected to the first and second springs completing a path for electrical current to energize the light source.

A further feature of the invention includes a pawl actuated by the plunger maintained in a first position and

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actuatable to a plurality of other positions by the second spring.

Still an additional feature is the provision of an over-center switch actuating member which is driven by the pawl member.

A further feature of the invention is the provision of a plunger having a conical surface for engaging flexible members to close the electrical circuits.

Another feature of the invention is to provide a retaining member for retaining the light transparent push button and the light source in the housing and allowing limited motion of the push button which is removable for replacing the light source.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings, wherein:

FIGURE 1 is a side view of a push button switch incorporating the invention;

FIGURE 2 is a partial cross-section view along lines 2—2 in FIGURE 1;

FIGURE 3 is a cross-sectional view normal to the plane of lines 2—2 in FIGURE 1, showing the switch in one position;

FIGURE 4 is a cross-sectional view normal to the plane of lines 2—2 in FIGURE 1, showing the switch in a second position;

FIGURE 5 is a fragmentary sectional view normal to the plane of lines 2—2 in FIGURE 1;

FIGURE 6 is a sectional view along lines 6—6 in FIGURE 4;

FIGURE 7 is a sectional view of a lighted push button switch showing a second embodiment of the invention;

FIGURE 8 is a sectional view along lines 8—8 in FIGURE 7;

FIGURE 9 is a sectional view along lines 9—9 in FIGURE 7;

FIGURE 10 is a fragmentary sectional view along lines 10—10 in FIGURE 7;

FIGURE 11 is a sectional view of a lighted push button switch showing a further embodiment of the invention;

FIGURE 12 is a sectional view of a lighted push button switch incorporating the switch in a second position;

FIGURE 13 is a sectional view along lines 13—13 in FIGURE 12;

FIGURE 14 is a sectional view showing a further embodiment of the invention;

FIGURE 15 is a sectional view showing the embodiment of FIGURE 14 wherein the switch is in the closed position; and

FIGURE 16 is a sectional view along lines 16—16 in FIGURE 14.

Referring now specifically to FIGURE 1, therein is shown a lighted push button switch having a push button 21 slidably mounted in a housing 22 and retained therein by a retaining ring 23. Ring 23 has a threaded portion which engages a thread portion on housing 22 and a pair of panel mounting members 24 and 24' threaded on housing 22 allow for mounting the push button switch to a panel (not shown). The contacts 25 are provided for making electrical connections to external electrical circuits to be controlled.

FIGURE 3 is a detailed cross-sectional view normal to the plane of lines 2—2 in FIGURE 1, including the

housing 22, push button 21, retaining ring 23 and mounting members 24, 24'. In addition, a light source 26 having terminals 27 and 28 is positioned within the push button by colored, translucent sleeve member 29 and an electrically conductive member 30. An electrically conductive spring 31 held in compression between a fixed member 32 and electrically conductive member 30 provides energy to return the push button to the extended position after it is depressed. An electrically insulating member 33 between rigid member 32 and housing 22 prevents electrical contact between spring 31 and housing 22.

A plunger 34, in contact with terminal 28, is slidably mounted within member 32. A second spring 35 rigidly mounted at its lower end to a lamp terminal 48 is under compression and maintains a pawl 36 in contact with plunger 34.

A switch actuating member 37 having camming surfaces 38 and 39 is pivotally mounted about a shaft 40 for actuation by pawl 36. In addition, member 37 contains a contact tip 41 maintained in contact with a contact bar 42 by a third spring 43.

Terminals 25 extend through an end member 44 and are adapted to complete electrical circuits through bar 42 when in contact therewith. Dashed line 45 represents an extension of spring 31 which is connected to a terminal 46 to provide an electrical conductor from terminal 46 to terminal 27 of light source 26.

FIGURE 4 is a cross-sectional view of the lighted push button switch of FIGURE 3, wherein the push button is shown in the depressed position, and member 37 is shown closing the contact between the lower terminal 25 and bar 42.

FIGURE 5 is a fragmentary view showing the plunger 34 in a depressed position and pawl member 36 engaging the lower portion of actuator 37.

FIGURE 2 is a partial phantom and cross-sectional view of the push button switch through a plane at right angles to the plane of the section shown in FIGURES 3 and 4. It more clearly shows the electrical connections to the light source 26 through springs 31 and 35. One end of spring 31 connected through the spring end 45 to terminal 46 provides the electrical circuit to the terminal 27 of light source 26 and the end 47 of conical spring 35 is connected to a terminal 48 providing the electrical connection through spring 35, pawl member 36, and plunger 34 to terminal 28 of light source 26.

FIGURE 6 shows conical spring 35 connected through the spring end 47 to terminal 48 for retaining pawl 36 in operative position.

The operation of the embodiment of the invention as shown in FIGURES 1, 2, 3, 4, 5, and 6 is as follows.

The overcenter actuator 37 is initially in one of the two positions that it may take, either closing the electrical contact between bar 42 and the upper or lower terminals 25. Depressing push button 21 transmits force through member 30 to terminal 27 of light source 26. Light source 26 in turn transmits the force through terminal 28, plunger 34 and pawl 36. The intersection of camming surfaces 38 and 39 is such that the rounded end of pawl 36 engages only one of the camming surfaces in its downward motion, and as shown in FIGURE 3, this would be camming surface 39. Conical spring 35 and spring 31 begin to compress. Pawl 36 travels along camming surface 39 until it engages the curved end portion thereof at which time actuator 37 starts to rotate about shaft 40 under the urging of pawl 36.

Spring 43 compresses and tip 41 rides along bar 42. When the contact tip 41 is moved past the center point of bar 42, the actuator 37 snaps into the other position under the urging of spring 43.

Releasing the depressing pressure on push button 21 allows spring 35 and 31 to return the push button to the stop portion of retaining ring 23, in addition pawl 36 is returned to its initial position.

On the next actuation of the push button to control the externally connected electrical circuits, pawl 36 engages camming surface 38 as shown in FIGURE 5 and over-center actuator 37 is rotated to its other position.

It is to be noted that changing of light bulb 26 is extremely easy, quick and does not require disassembling the push button switch in its entirety. It is merely necessary to remove retaining ring 23. The push button, sleeve and light source are then removable from the housing while the balance of the switch is rigidly held in place by rings 24 and 24'. Orientation of the push button is accomplished by a slot 32' and key 32" so that any printed legend on the button is maintained in its proper readable position.

The embodiment shown in FIGURES 7, 8, 9 and 10 contains an open-ended push button housing 51 closed at one end by an end member 52 and a push button 53 retained in housing 51 by a retaining ring 54. The threaded portion 55 is provided for engaging the retaining ring 54. An insert 60 provides electrical contact from spring 59 to terminal 57 of light source 56.

A fixed member 61 which is a non-conductor is supported in housing 51 by a sleeve 62 and supports a plunger 63 for longitudinal motion. A pawl 64 is held in firm electrical and mechanical contact with plunger 63 by a conically-shaped electrically conductive spring 65.

An over-center switch actuator 66 is pivoted about a shaft 67 and contains a contact tip member 68 held in contact with a rocker bar 69 by a third spring 70. In addition, the actuator contains a camming surface 71 adapted to engage the rounded end of pawl 64. A nipple 72 on actuator 66 is provided for maintaining a fourth spring 73 mechanically engaged therewith. The other end of spring 73 engages the member 61 and is guided thereon by a nipple 74.

Terminals 75, 76, 77, 77' and 78 extending through end member 52 are provided for connecting the push button switch to external electrical circuits. Terminal 77 is shown connected to dashed lines 79 representing end of spring 65 connected to terminal 77. Terminals 75 and 78 are adapted to complete electrical circuits through rocker bar 69 and terminal 76 when there is mechanical coupling between either 75 or 78 and rocker bar 69. Rocker bar 69 is pivoted on common terminal 76.

The cross-sectional view in FIGURE 8 along lines 8-8 in FIGURE 7 shows the housing 51, spacer 62 and springs 65 and 73. The end of spring 65 is shown brought out to one side of the housing. A stop member 82 affixed to a plate 83 maintains the spring 65 in proper alignment and also prevents pawl 64 from improper operation. A wire shown in cross-section 84 is an extension of spring 59.

FIGURE 9, a sectional view along lines 9-9, in FIGURE 7, shows the electrical conductors 79 and 84, housing 51 insulator 62 and in addition shows a spacer element 85. Wires 79 and 84 are shown connected to terminals 77 and 77'. Terminals 75, 75', 76, 76', 78 and 78' are shown for completing the electrical circuit when actuated by the rocker bar 69.

FIGURE 10 is a fragmentary section view along line 10-10 in FIGURE 7. This figure shows details of the overcenter actuator mounting. An insert 86 having two bearing surfaces 87 and 87' is mounted in the housing 51 and is supported against end member 52. Shaft 67 of actuator 66 rotates in the bearing surfaces under the urging of pawl 64. The bar 69 shown in cross-section, electrically connects terminals 75, 75' and 76, 76' when in contact therewith. The wires 79 and 84 which provide the electrical path for the light are shown soldered to terminals 77 and 77'.

The operation of the embodiment shown in FIGURES 7, 8, 9 and 10 is as follows.

Force applied to the push button 53 is transmitted through electrically conductive sleeve 60 to terminal 57 of light source 56. Terminal 58 of the light source

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presses against plunger 63 which, in turn, forces pawl 64 against the spring 65.

Assuming initial conditions wherein the button is not depressed, pawl 64 is in substantially a centered position and is at rest against spring 65 and stop 82. Actuator 66 would be in the other position than shown in FIGURE 7. Depressing the push button causes pawl 64 to move against camming surface 71 and to come to rest against curved end portion thereof. Actuator 66 is rotated about shaft 67 and tip member 68 rides across the bar 69 and when it is urged past the central position, spring 70 causes a snap action closing of bar 69 to terminal 78.

While the button is depressed, spring 73 is compressed and when the push button is released, spring 73 causes the overcenter actuator to return to its original position.

The embodiment in FIGURES 11, 12 and 13 of a lighted push button switch show the invention used with a different contact closing member.

A housing 90 and an insulating member 91 are joined to an end closing member 92. A push button 93 is slidably mounted in the end of housing 90 and is retained therein by a retaining ring 94 threaded to engage thread 95 on housing 90. A spring 96 maintains the push button in the extended position. A rigidly mounted electrically nonconductive member 97 has a portion adapted to receive an electrically conductive plunger 98. A spring 99 tends to return the plunger 98 to its extreme leftward position through a cap member 100.

A third spring 101, under compression between cap 100 and a pawl 102 maintains pawl member 102 in mechanical contact with plunger 98. An overcenter actuator 103 rotates about a shaft 104 and has a pair of camming surfaces 105 and 106. The actuator also has a pair of finger-like extensions 107 and 108 adapted to receive a spring member 109 slidably therebetween. Terminals 110 and 111 extending through end member 92 have contacts 112 and 113 on the inner ends thereof. Member 109 contacts a V-shaped terminal slot 114' of a terminal 114 extending through end member 92 and in addition contains a pair of contacts 115 and 116.

A stop member 117 provides a limit of travel position for pawl 102 and in addition provides a point for spring 99 to become compressed against.

FIGURE 13 which is a section view along lines 13—13 in FIGURE 12 shows the housing 90 and insulating member 91. 118 and 119 represent terminals to which are connected electrical connectors which respectively are joined to ends of spring 96 and spring 99.

The electrical circuit for a light 120 of this embodiment consists of terminal 118, a wire connecting it to spring 96, electrically conductive member 121, terminal 122 of light source 120, the light source, terminal 123, plunger 98, electrically conductive cap 100, spring 99, the end of spring 99 connected to terminal 119.

In operation, depressing push button 93 causes an actuating force to be transmitted through terminals 122 and 123 to plunger 98. Plunger 98 travels towards the right and pawl 102 engages camming surface 106, as shown in FIGURE 11. The pawl travels on the camming surface 106 until it reaches the notched end portion thereof and then causes actuator 103 to rotate about shaft 104. Spring member 109 is moved from the upper to lower position and contacts 113 and 116 are opened while contacts 115 and 112 are closed. The spring tension of member 109 maintains the contacts closed until the next actuation of the push button.

A lighted push button switch wherein the contacts are closed only during depressing of the push button is shown in the embodiment represented by FIGURES 14, 15 and 16. FIGURE 14 shows the switch in a non-depressed position and FIGURE 15 shows the push button as depressed.

Referring now to FIGURE 14, an open end housing 125 has a threaded portion 126. A push button 127 is

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retained in the open end portion of housing 125 by a retaining ring 128. A member 129 rigidly attached to housing 125 has a bearing surface 130 and 131 adapted to receive a plunger 132. Plunger 132 contains a collar 133 and a conically-shaped insulating member 134. A retaining ring 135 affixed to housing 125 serves to retain a spring 136 in compression against collar 133.

A second spring 137 is in compression between member 129 and a collar 138 on push button 127.

Terminals 140, 141, 142 and 143 extend through an end member 144 affixed to housing 125. The terminals respectively carry contacts 146, 147, 148 and 149. Terminals 141 and 142 have flaring inner end portions 150 and 151 adapted to engage insulated conical section 134 when plunger 132 is extended to the right.

The construction of the push button 127 is shown in FIGURE 15 wherein a light source 160, having terminals 161 and 162, is maintained in contact with the collar 138 by spring 137.

FIGURE 16 is a section view along lines 16—16 in FIGURE 14 and shows in addition to the terminals 140, 141, 142 and 143 a pair of terminals 163 and 164. It is to be understood that terminals 163 and 164 are connected electrically to the ends of springs 137 and 136.

In operation, depressing the push button 127 transmits force through the terminals 161 and 162 of light source 160 and causes plunger 132 to move to the right. Conical surface 134 engages the flaring portions 150 and 151 causing contacts 146 and 147 and contacts 148 and 149 to close. As long as the push button is depressed, the contacts remain closed and upon releasing of the push button 127, springs 136 and 137 return the push button, light source and plunger to their normal rest positions.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A push button switch for controlling electrical circuits comprising: an open-ended housing; a light transparent push button slidably mounted in said open end of said housing and retained therein for limited longitudinal motion; a light source having first and second terminals; means maintaining said push button in contact with said first terminal; a first spring in electrical contact with said first terminal and urging said push button toward the open end of said housing; an electrically conductive plunger slidably mounted in said housing; a second spring maintaining said plunger in contact with said second terminal of said light source; a switch having two positions and a plurality of contacts actuatable by said plunger, switch actuating motion of said push button transmitted to said plunger through said first and second terminals; means including a plurality of terminal posts extending through said housing for coupling said switch contacts to said electrical circuits; and means including two of said terminal posts extending through said housing electrically connected to said first and second springs for providing a closed path for electrical current to energize said light source.

2. An illuminated push button switch for controlling electrical circuits comprising: an open-ended housing including an actuatable switch having a plurality of contacts for controlling said circuits; a light transmitting push button slidably mounted in said open end of said housing and retained therein for limited longitudinal motion, said push button having an end portion; an electrically conductive member positioned against said end portion; first spring means biasing said member into engagement with said end portion and urging said push but-

ton toward the open end of said housing; a light source in said push button and having first and second terminals, said first terminal being positioned against said conductive member; an electrically conductive plunger slidably mounted in said housing and adapted to actuate said switch, said plunger being positioned against said second terminal; second spring means biasing said plunger into engagement with said second terminal and urging said first terminal into engagement with said conductive member; and means connecting said springs to a source of electrical energy to energize said light source.

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